REMARKS

The non-final Office Action mailed August 11, 2004, has been received and reviewed. Claims 1-30 are pending in the application. Claims 8-22, 30 are withdrawn from consideration. Claims 1-7, 23-29 have been rejected. As of this Amendment, Applicants have amended Claims 1 and 23. In view of this Amendment, Claims 1-7, 23-29 are believed to be in condition for allowance, and Applicants respectfully request entry of this amendment and reconsideration of the application as amended herein.

Introduction

The present invention concerns a field emission planar electron emitter device that has an emitter electrode, an extractor electrode, and a planar emitter emission layer, electrically coupled to the emitter electrode and the extractor electrode. The planar electron emitter is configured to bias electron emission in a central region of the emission layer in preference to an outer region thereof. In one embodiment, the electron emission bias is achieved by fabricating the planar emitter emission layer so that it has an outer perimeter that is thicker in depth than at an interior portion of the planar emitter emission layer, which reduces electron beam emission at the outer perimeter when an electric field is applied between the emitter electrode and the extractor electrode. The electric field draws emission electrons from the exposed surface of the planar emitter emission layer towards the extractor electrode at a higher rate at the interior portion than at the outer perimeter.

35 U.S.C. § 102(b) Rejections

The Examiner has rejected Claims 11, 3-5, 7, 23, 24, 27 and 28 under 35 U.S.C. Section 102(b). Claims 1, 3-5, 7 are rejected as being anticipated by Van Gorkom et al. (US 4,370,797). Van Gorkom discloses a semiconductor device for generating electron beams primarily using a p-n junction. Aperture 8 constitutes the effective exposed surface of the emitter, because insulating layer 7 covers the remaining portion of the structure. The electron emission is enhanced in the center of the aperture 8 by providing a highly doped p-type region 12 adjacent to an n-type region 3. This doping arrangement results in a depletion zone 10 in the central portion of aperture 8, providing an avalanche of electrons in that area.

In Van Gorkom, the thickness of the n-type region 3 is the same throughout the exposed surface area not covered by the insulating layer 7 and does not affect the amount of the electrons generated. The fact that the portion of the n-type contact zone 14 is thicker is of no consequence, since the thicker portion is beneath the insulating layer 7 and does not function as an effective exposed surface of the emitter.

In contrast, the electron emission activity in the present invention occurs primarily in the center of the exposed surface of the semiconductor layer because, as shown in Figure 7 of the present application, the semiconductor layer 216b is thinner than the outer perimeter semiconductor portion 216a of the exposed surface. Thus, in the present application, the electron emission is greater in the center portion of the exposed surface of the electron emitter because of a structural difference, i.e., the semiconductor layer is thinner than on the perimeter. In Van Gorkom, the electron emission is greater in the center portion of the exposed surface of the electron emitter because of a doping difference, i.e. the p-type semiconductor is more highly doped in the depletion region.

Claim 1 of the present application already states that the electron emissions come from the exposed surface of the semiconductor layer above the metal-semiconductor junction. See also page 5, line 26 and page 10, line 6 in the specification. Claim 1 has been amended to clarify that it is the exposed surface of the semiconductor layer that has a thicker depth at the perimeter than at the interior portion. This change in thickness of the exposed surface of the semiconductor layer is what affects the amount of electron emission. This is in contrast to the Van Gorkom disclosure showing the thickness of the exposed surface of the semiconductor layer 3 or the metallic layer 31 as being substantially the same. The variation in electron emission occurs because of a more highly doped central portion. Accordingly, it is submitted that claim 1 is allowable as amended.

Claims 3-5 and 7 are dependent on claim 1 and are therefore allowable for the same reasons stated with respect to claim 1. In addition, claim 4 describes the electron emitter as comprising a metal first layer and a semiconductor second layer deposited on the metal first layer. In Van Gorkom, the electron emission occurs by applying voltages across a p-n junction between two semiconductor materials. Electrons are generated by avalanche multiplication which emanate from the semiconductor body. See column 7, lines 18-25. Accordingly the electron emitter does not comprise a metal first layer and a semiconductor second layer deposited on the metal first layer, as stated in claim 4.

Claims 23, 24, 27, and 28 are rejected as being anticipated by Gray (US 5,266,155). The Examiner refers to Figure 11 in the Gray patent where the electrons extracted from emitters 22 appear to be focused by conductors 29 to the center of the aperture 34. As stated in column 7, lines 49-51, the control layer 29 acts to focus or deflect the electrons that have been generated. This is not at all the same effect as in the present invention, wherein the planar electron emitter is configured to bias the electron emission in a central region. In

Gray, there is no structural configuration of the emitters 22 that would tend to cause electron emission in a central region rather than an outer region of the aperture.

Claim 23 has been amended to indicate that the emitter is configured with a variable thickness, so as to bias electron emission in a central region in preference to an outer region. Clearly, the configuration of emitters 22 in Figure 11 do not have a variable thickness that causes electrons to be emitted in a central region of the aperture 34. Rather, the focusing effect of conductors 26 and 29 are what cause the electrons to be directed to the center of aperture 34. Accordingly, claim 23, as amended, is clearly allowable over the Gray patent.

Claims 24, 27 and 28 are all dependent on claim 23 and are therefore allowable for the reasons given above.

35 U.S.C. § 103(a) Obviousness Rejections

The Examiner has rejected Claims 2, 6, 25, 26, and 29 under 35 U.S.C. § 103(a) for obviousness. M.P.E.P. 706.02(j) sets forth the standard for a § 103(a) rejection:

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 U.S.P.Q.2d 1438 (Fed. Cir. 1991). (Emphasis added).

Claims 2 and 6 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Van Gorkom in view of Christensen (US 4,498,952). Claim 2 is dependent on claim 1, which as amended, clearly distinguishes over Van Gorkom. Christensen is cited only for the proposition that the focusing electrode is electrically coupled to the planar electron emitter. The combination of Van Gorkom and Christensen do not show an electron emitter having an exposed surface that varies in thickness to draw electron emissions more heavily from the interior portion of the emitter. The use of a focusing electrode only causes focusing of the already emitted electron from the Van Gorkom apparatus, rather than influencing the electron emission itself. Therefore, the combination of Van Gorkom and Christensen does not render the invention described in claim 2 obvious.

Likewise, claim 6 is dependent on claim 1 and patentably distinguishes over the combination of Van Gorkom and Christensen for the reasons indicated above.

Claims 25, 26 and 29 have been rejected under Section 103 as being unpatentable over Gray in view of Van Gorkom. Claim 25 is dependent on claim 23 and is therefore distinguishable over the Gray reference as indicated above. The combination of Gray and Van Gorkom does not disclose an electron emitter being configured with a variable thickness to thereby bias the electron emission in a central region in preference to an outer region. Gray only shows conductors above the emitters that tend to focus the electrons after they have been emitted. There is no biasing of the electron emission itself, and the emitter is not configured with a variable thickness, as in the present disclosure. Thus, claim 25 clearly distinguishes over the Gray disclosure. The Van Gorkom reference only adds the concept of having a concave top surface. It does not add the variable thickness limitation that causes the bias of electron emission from the emitter. Thus, the key emitter configuration in the present disclosure of having a variable thickness is not rendered obvious by the combination of Gray with Van Gorkom.

Claims 26 and 29 are dependent on claim 23, and are therefore patentably distinct over a combination of Gray and Van Gorkom for the reasons given above.

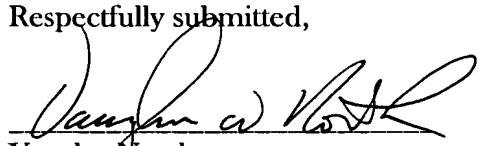
CONCLUSION

Claims 1-7, 23-29 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, he is respectfully invited to contact Applicants' undersigned attorney at the number given below.

The Commissioner is hereby authorized to charge any additional fee or to credit any overpayment in connection with this Amendment to Deposit Account No. 08-2025.

DATED this 11 day of November, 2004.

Respectfully submitted,



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